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The apparent rediscovery of *Nematopagurus scutellichelis* Alcock, 1905 (Decapoda: Anomura: Paguroidea: Paguridae) in the South China Sea, with notes on other regional species of the genus

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Abstract.—The accuracy of records of species of the hermit crab genus *Nematopagurus* occurring in the South China Sea has been evaluated using collections from the Hainan Island region. Information gleaned from this material strongly suggests that previous reports have been inaccurate. None of the reported four species, *N. gardineri* Alcock, *N. indicus* Alcock, *N. muricatus* (Henderson), and *N. squamichelis* Alcock have been recognized among the extensive collections of the Institute of Oceanology, Chinese Academy of Sciences, Qingdao, People's Republic of China. Nevertheless, a total of seven species of *Nematopagurus* have been identified, including what appears to be *N. scutellichelis* Alcock. If correct, this would be the first record of this species since its original description. The other six are also known species; however, most represent new distributional records.

Nematopagurus A. Milne-Edwards & Bouvier, 1892 is one of several genera of the hermit crab family Paguridae characterized by a sexual tube produced from, or developed in conjunction with, the male right gonopore that is usually elongate and often filiform. Typically, a similar, but very much shorter tube is produced from the left gonopore. Females of this genus also develop paired and modified first abdominal pleopods. At present, 24 species are assigned to the genus (McLaughlin 1998), all but one of which occur in the IndoPacific region. In a recent summary of the hermit crab fauna of the South China Sea, Rahayu (2000) listed four species of *Nematopagurus*. For the most part, Rahayu's report was a compilation from the existing literature. The occurrences of *N. indicus* Alcock, 1905b and *N. squamichelis* Alcock, 1905b, in the South China Sea had been reported by Wang & Huang (1979). *Nematopagurus gardineri* Alcock, 1905a and *N. muricatus* (Henderson, 1896) were added to the Chinese faunal list by Wang (1983). Rahayu (1996) also recorded *N. muricatus* from Singapore and Malaysia. While absent from the South China Sea, *N. vallatus* (Melin, 1939) was recorded from the East China Sea by Wang (1992). All five species were included by Wang (1994) in his list of "Marine Species and Their Distributions in China's Seas". Unfortunately none of these species identifications were correct.

Regrettably, Wang's (1994) specimens have not been available for reexamination. However, extensive surveys in the Hainan Island region of the South China Sea were conducted by Chinese research vessels (R/V) during the National Comprehensive Oceanographic Survey (NCOS) of 1958–1960, with supplemental sampling in the East China Sea in 1976, by the Institute of Oceanology, Chinese Academy of Sciences (IOCAS). These surveys resulted in the collection of a wealth of hermit crabs that have

allowed us to evaluate the species of *Nematopagurus* occurring in Chinese Seas. We also have reexamined the specimens from Singapore referred by Rahayu (1996) to *N. muricatus* and deposited in the Raffles Museum of Biodiversity Research, National University of Singapore (ZRC); the specimen identified by Balss (1912) as *N. indicus* from the Nicobar Islands in the collections of the Naturhistorisches Forschungsinstitut Museum für Naturkunde zu Berlin, Berlin, Germany (ZMB); and specimens in the collections of the Institute of Oceanology, Chinese Academy of Sciences (IOCAS), identified by resident scientists as *N. muricatus* and *N. squamichelis*.

A species not recognized by previous Chinese carcinologists, but present in the Institute of Oceanology collections, is a taxon identified by the present authors as *Nematopagurus scutellichelis* Alcock, 1905b. This species was described by Alcock (1905b) from a single male specimen collected in the Indian Ocean between the Maldives and Cape Comorin at a depth of 1507 m. Any subsequent reports of this species have merely been literature citations of the original record (e.g., Gordan 1956). The species collected during the Hainan Survey is from much shallower depths. Nonetheless, it agrees, with the exception of setation, entirely with Alcock's description and illustration. The policy of the Indian Museum, Calcutta, to not lend materials, has precluded personal examination of the holotype; however, in view of the setal variation common to species of this genus (McLaughlin, pers. obs.), we believe that the specimens redescribed herein as *N. scutellichelis* are true representatives of Alcock's taxon.

In addition to *N. scutellichelis,* the Institute of Oceanology collections contain the following species of *Nematopagurus*: *N. australis* (Henderson, 1888) = *N. muricatus* sensu Wang (1983) and Rahayu (1996); *N. lepidochirus* (Doflein, 1902) = *N. squamichelis* sensu Wang & Huang (1979), Huang (1989), and Wang (1994); *N. tricarinatus* (Stimpson, 1858) = *N. vallatus* sensu Wang (1992, 1994); *N. alcocki* McLaughlin, 1997 = ?*N. indicus* sensu Wang & Huang (1979), Wang (1983, 1992, 1994), Huang (1989); *N. meiringae* McLaughlin, 1998 = ?*N. gardineri* sensu Wang (1983, 1992, 1994), Huang (1989); and *N. diadema* Lewinsohn, 1969, heretofore reported only from the Red Sea and eastern coast of South Africa. Although all are known species, only *N. tricarinatus* has been reported previously from the South China Sea. A complete redescription is presented herein for *N. scutellichelis,* whereas the other species in the Institute of Oceanology collections are discussed only as they pertain to previous misidentifications. However, pertinent, albeit not complete, synonymies are included. Descriptions and/or diagnoses of these species have been presented by McLaughlin (1997, 1998, 2002) and Komai & McLaughlin (2001).

In the materials examined, one measurement, shield length (sl), as measured from the midpoint of the rostral lobe to the midpoint of the posterior margin of the shield provides an indication of specimen size. The abbreviation Stn. refers to ship stations, while ovig. refers to the ovigerous condition of some females. Terminology used in the description of *N. scutellichelis* generally follows that of McLaughlin (1998). The ratio of corneal diameter to peduncular length was obtained by comparing maximum corneal width to maximum peduncular length measured on the lateral surface of the peduncle from the distal corneal margin to the proximal margin of the distal segment of the peduncle. Interpretation of the ocular acicle follows that of Forest et al. (2000), not that of Boyko & Harvey (1999). Borrowed specimens have been returned to the lending institutions. The majority of specimens are deposited in the collections of the Institute of Oceanology, Chinese Academy of Sciences, Qingdao, People's Republic of China; however, where adequate numbers of specimens have allowed, representatives have also been placed in the collections of

the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM).

Nematopagurus scutellichelis
Alcock, 1905
Fig. 1

Nematopagurus scutellichelis Alcock, 1905b:112, pl. 12, fig. 3.

Material examined.—S.E. off Hainan Island, South China Sea: R/V2, NCOS Stn 6091, 20°30′N, 112°30′E, 78 m, 7 May 1959, 1 ♂ sl = 4.1 mm, IOCAS K57B; R/VS, NCOS Stn 6052, 21°30′N, 114°00′E, 48 m, 17 Mar 1959, 1 ovig. ♀ sl = 3.6 mm, IOCAS S15BS; R/V21, NCOS Stn 6107, 20°00′N, 112°00′E, 92 m, 4 Apr 1960, 1 ♂ sl = 2.7 mm, IOCAS K147B; R/V101, NCOS Stn 6161, 18°15′N, 110°30′E, 106 m, 7 May 1959, 1 ♂ sl = 4.2 mm, IOCAS N197B; R/V171 NCOS Stn. 6107, 20°00′N, 112°00′E, 96.5 m, 20 Apr 1959, 1 ♀ sl = 3.2 mm, IOCAS L57B; R/V171, NCOS Stn 6166, 16°30′N, 110°30′E, 72 m, 20 Apr 1959, 3 ♂ sl = 2.0–3.0 mm, 2 ♀ sl = 3.2, 3.6 mm, 1 ovig. ♀ sl = 3.0 mm, IOCAS L568-62; R/V220, NCOS Stn. 6017, 22°00′N, 116°30′E, 88 m, 23 Apr 1959, 1 ♂ sl = 2.2 mm, IOCAS S229B; R/V220, NCOS Stn 6037, 21°30′N, 115°00′E, 90.4 m, 4 Jul 1959, 1 ♂ sl = 4.8 mm, USNM 1003650; R/V220, NCOS Stn. 6054, 21°00′N, 114°00′E, 80 m, 10 Dec 1959, 2 ♀ sl = 2.0, 2.4 mm, IOCAS S141B.

Redescription.—Shield (Fig. 1a) broader than long; anterolateral margins sloping; posterior margin roundly truncate, usually with small median concavity; dorsal surface with few sparse tufts of short setae laterally and anteriorly. Rostrum very broadly rounded, sometimes produced to level of lateral projections. Lateral projections moderately well developed; each with mesially or laterally directed, marginal or submarginal spinule.

Ocular peduncles 0.80–1.00 length of shield; dorsal surfaces each with median sparse tuft of stiff setae at corneal indentation, dorsal and/or dorsomesial surface(s) with sparse tuft(s) of setae; corneal diameter 0.55–0.70 of peduncular length. Projection of ocular acicles small, subrectangular; terminating subacutely, with deeply concave dorsal surface and well developed submarginal spine.

Antennular peduncles exceeding distal margins of corneas by 0.30–0.50 length of ultimate segments. Ultimate segment with sparse tuft of setae at dorsolateral distal margin, few additional sparse tufts on dorsal or dorsolateral surfaces; penultimate segment with few scattered setae. Basal segment with acute spine on distal margin of statocyst lobe.

Antennal peduncles overreaching distal margins of corneas by 0.10–0.20 length of fifth segments. Fifth and fourth segments each with few to several tufts of simple setae. Third segment unarmed, but with tuft of long, stiff setae at ventrodistal angle. Second segment with dorsolateral distal angle prominently produced, terminating in acute spine, lateral and mesial margins with few stiff setae; dorsomesial distal angle with small spine. First segment unarmed. Antennal acicle moderately long, reaching beyond proximal half of ultimate peduncular segment; arcuate, terminating in acute spine; mesial margin with tufts of long stiff setae. Antennal flagella long, overreaching tip of right cheliped; most articles each with 1 or 2 extremely short setae or bristles, at least proximally.

Chelipeds subequal; right (Fig. 1b) slightly, if at all, longer, but stouter than left, both moderately elongate. Dactyl of right cheliped appreciably shorter to nearly equaling length of palm; cutting edge with several, sometimes fused, calcareous teeth and short row of corneous teeth in distal 0.20–0.25, terminating in small corneous claw and slightly overlapped by fixed finger; dorsal surface with longitudinal row of scutes, extending onto rounded dorsomesial margin, each with marginal row of short stiff setae, few tufts of short setae near tip

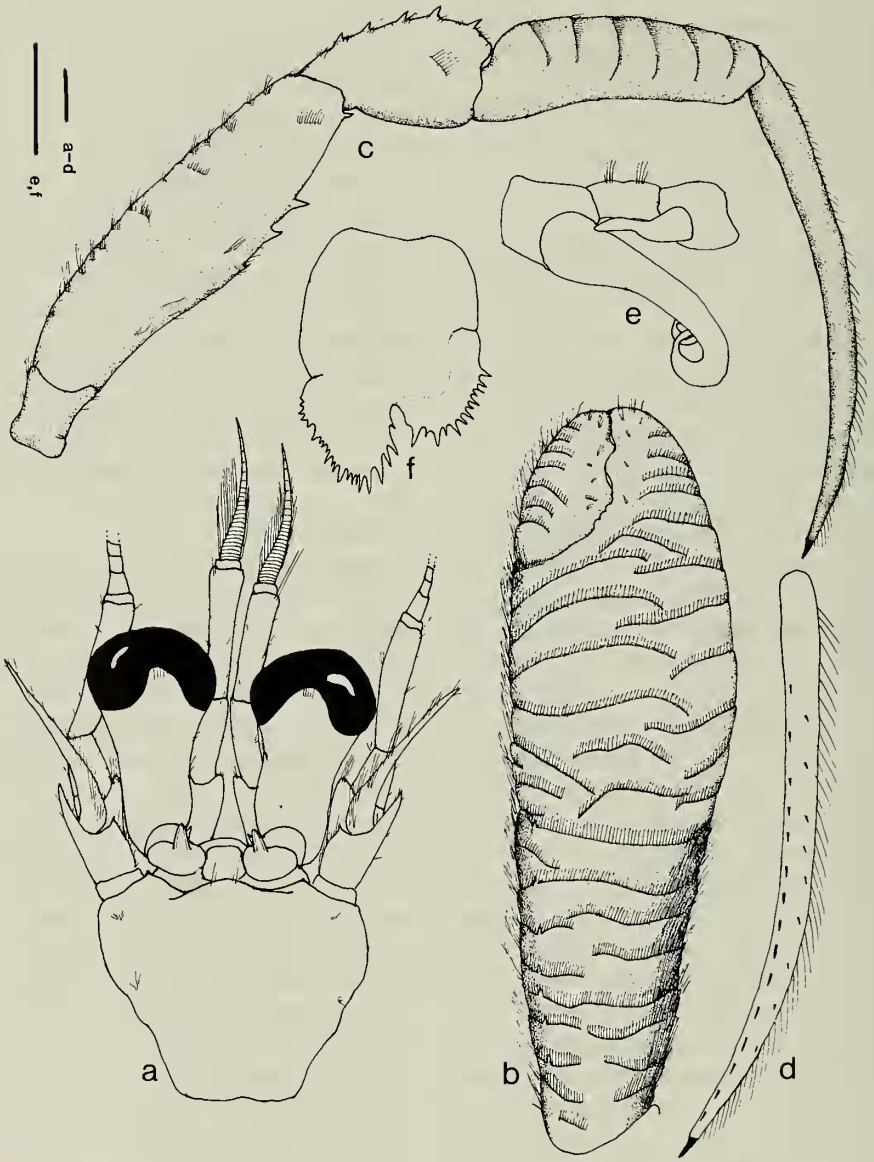

Fig. 1. *Nematopagurus scutellichelis* Alcock, 1905, ♂ sl = 4.8 mm, R/V220, NCOS Stn. 6037, USNM 1003650: a, shield and cephalic appendages; b, carpus and chela of right cheliped (dorsal view); c, right second pereopod (lateral view); d, left third dactyl (mesial view); e, sternite and coxae of fifth pereopods (ventral view); f, telson. Scales equal 1.0 mm.

and adjacent to cutting edge; mesial face ventrally and ventral surface with tufts of long setae. Palm 0.80 to nearly as long as carpus; dorsomesial margin not delimited; dorsal surface with 6–8 rows of partially to nearly complete transverse scutes continued onto lateral, mesial, and ventral surfaces, each with marginal row of short stiff setae; dorsal surface of fixed finger with moderate to short transverse rows of scutes extending nearly to tip and provided with marginal short stiff setae, few sparse tufts of setae near tip; cutting edge with row of calcareous teeth, terminating in tiny corneous

claw; scutes of mesial and ventral surfaces of palm accompanied by longer setae, often particularly dense on mesial face of palm. Carpus slightly longer than merus; dorsodistal margin with row of uniformly short stiff setae; dorsal surface with complete or incomplete transverse scutes extending onto lateral and mesial faces and provided marginally with short stiff setae, most scutes interrupted at dorsomesial margin by moderately small to prominent spine; dorsolateral margin not delimited; ventral surface with transverse rows of long setae. Merus subtriangular; dorsal margin, mesial and lateral faces all with transverse ridges and long stiff setae; ventrolateral margin with 2 spines in distal 0.50; ventromesial margin with 1 spine distally, ventral surface with few low ridges and tufts of setae. Ischium with small acute or blunt spine at ventrolateral angle.

Left cheliped usually reaching nearly to tip of dactyl of right; moderately slender. Dactyl usually slightly longer than palm; cutting edge with row of small corneous teeth, terminating in small corneous claw and slightly overlapped by fixed finger; dorsomesial margin rounded, dorsal surface with few sparse tufts of short setae adjacent to cutting edge, 1 longitudinal row of marginally setiferous scutes, each extending onto mesial face; ventral surface with few tufts of setae. Palm approximately 0.75 length of carpus; dorsomesial margin rounded; dorsal surface, like that of right, with 6–8 transverse rows of complete or incomplete scutes, each extending onto lateral and mesial faces and provided with marginal row of short stiff setae, most proximal scute sometimes with small subacute spine at dorsomesial margin; dorsal surface of fixed finger with several short transverse scutes, each with marginal fringe of short stiff setae; cutting edge with row of small calcareous teeth interspersed with corneous teeth. Carpus approximately 1.10–1.30 longer than merus; dorsodistal margin with uniform row of short stiff setae, dorsomesial margin with row of prominent spines, dorsolateral margin not delimited; dorsal surface with several complete or more frequently interrupted, marginally setiferous scutes extending onto lateral and mesial faces; ventral surface with tufts of setae, 1 small spine at ventrolateral distal angle. Merus subtriangular; dorsal surface with transverse ridges and stiff setae, distal margin with row of moderately long stiff setae; lateral and mesial faces with tufts of stiff setae; ventral surface with few ridges and tufts of setae; ventromesial margin with 1 acute spine usually and 2 or 3 low protuberances; ventrolateral margin with 1 or 2 spines distally. Ischium with acute or blunt spine at ventrolateral angle.

Ambulatory legs (Fig. 1c, d) overreaching tip of right cheliped by at least 0.50 length of dactyl. Dactyls approximately twice length of propodi; in lateral view straight or slightly (second) to distinctly (third) curved ventrally; in dorsal view, slightly twisted; each terminating in moderate to strong corneous claw; dorsal surfaces each with row of moderately long stiff setae; mesial faces each with row of corneous spinules dorsally and row of 9–15 corneous spines at ventromesial margin (not visible in lateral view). Propodi approximately 0.35 longer than carpi; dorsal surfaces presenting "polished" appearance, each circumscribed by 6 or 7 weakly piliferous scutes. Carpi 0.45–0.55 length of meri; dorsal surface of second pereopods each with row of spines accompanied by tufts of short stiff setae; third pereopods each with similar tufts of stiff setae as well as dorsodistal spine and at least 1 additional spine in proximal half; lateral faces each with 1 or 2 short, oblique rows of stiff setae, ventral and mesial surfaces glabrous or with few tiny tufts of very short setae. Meri laterally compressed; dorsal surfaces each with row of transverse ridges and stiff setae; lateral faces each with 1 or 2 sparse longitudinal rows of short setae; mesial faces glabrous or with very few sparse tufts of short setae; ventrolateral margins of second pereopods each with small, acute spine at

distal angle and 3–5 additional spines marginally, accompanied by sparse tufts of setae; third only with tufts of setae. Ischia each with few setae dorsally and ventrally. Anterior lobe of sternite of third pereopods roundly subquadrate, with long setae on anterior margin.

Males with well developed, elongate, terminally spiraled sexual tube on coxa of right fifth pereopod, left with sexual tube developed as short to moderate tube, varying from approximately equal to nearly twice coxal length (Fig. 1e). Telson (Fig. 1f) with posterior lobes asymmetrical, roundly or subacutely triangular; separated by moderate to deep median cleft; terminal margins oblique, each with 3–6 acute spines; lateral margins oblique, each with row of smaller acute or subacute spines.

Color.—Not known.

Habitat.—Sand and mud substrates in South China Sea.

Distribution.—Eastern Indian Ocean, 1507 m; South China Sea, 48–106 m.

Remarks.—As indicated previously, the several specimens collected in the South China Sea agree entirely with Alcock's (1905b) description of *N. scutellichelis,* except for setation. The scutes on the propodi of the ambulatory legs of Alcock's specimen reportedly were "nude and polished"; the dactyls were "perfectly nude". The scutes on these appendages in our specimens all are provided with short, stiff setae; each dactyl has a row of long stiff setae on the dorsal margin. The chelae and other appendages also are provided with additional setae apparently absent from Alcock's specimen. However, setal variation in *Nematopagurus* species is subject to great variation (McLaughlin, pers. obs.). Alcock (1905b) also indicated and illustrated ambulatory dactyls that lacked any spinulation on the ventral margins. Although a ventral row of short corneous spines is present on each dactyl in all of our specimens, the twisting of the dactyls is such that these spines occur on the ventromesial surface and are not visible in lateral view. It is probable that Alcock simply did not notice these spines, which are present in all species of the genus.

Differences in the depths at which the South China Sea specimens and Alcock's (1905b) were collected, 48–106 m and 1507 m respectively, are appreciable. However, depth collection extremes also are noted for *N. longicornis* A. Milne-Edwards & Bouvier, 1892. A. Milne-Edwards & Bouvier (1892) cited the depth distribution for *N. longicornis* as 75–800 m; however, station data for "Talisman" sample no. 28, one of the stations at which *N. longicornis* reportedly was collected, listed a depth of 2600 m (A. Milne-Edwards & Bouvier 1900). Considering the morphological agreement between Alcock's (1905b) description and our South China Sea specimens, we feel confident that the latter truly represent Alcock's taxon, the broad geographic separation not withstanding. *Nematopagurus diadema,* heretofore known only from the Red Sea and eastern South Africa now also has been found in the South China Sea.

Nematopagurus alcocki McLaughlin, 1997

?*Nematopagurus indicus*—Wang & Huang, 1979:63, fig. 3.—Wang, 1983:54 (list); 1992:61 (list); 1994:571 (list).—Huang, 1989:253, fig. 214 (not *Nematopagurus indicus* Alcock, 1905b).

Nematopagurus alcocki McLaughlin, 1997: 517, fig. 23a–i.

Material examined.—R/V21, NCOS Stn. 6093, 19°30′N, 112°30′E, 219 m, 17 Feb 1959, 3 ♂ sl = 1.8–3.3 mm, 2 ♀ sl = 2.7, 2.8 mm, IOCAS 6–21; R/V101, NCOS Stn. 6123, 18°30′N, 111°30′E, 220 m, 8 Feb 1960, 1 ♂ sl = 2.3 mm, IOCAS N115B.

Remarks.—One of the two lots of *N. alcocki* previously had been identified as *N. muricatus* by resident scientists at the Institute of Oceanology, although all of the other samples similarly identified as Henderson's (1896) taxon are referable to *N. australis.* Türkay (1986) pointed out the very

distinctive armature of the chelae of *N. muricatus* when he described *Nematopagurus lewinsohni* Türkay, the species Lewinsohn (1969) had misidentified as *N. muricatus.* Nonetheless, species in the South China Sea with spinulose palms similarly continued to be identified as *N. muricatus* (e.g., Wang 1994; Rahayu 1996, 2000). *Nematopagurus australis,* another regional species, and *N. alcocki* are morphologically quite similar, although the dorsal surfaces of the chelae of *N. australis* are usually somewhat more spinose than those of *N. alcocki.* However, spination, like setation, is subject to considerable variation. The most reliable character for separating the two taxa is the dorsomesial margin of the dactyl of each cheliped. This margin bears a row of spines in *N. australis,* but is unarmed in *N. alcocki.*

Another of Alcock's (1905b) species that is poorly known is *N. indicus.* Until questionably identified from Indonesia by McLaughlin (1997), *N. indicus* had only been reported correctly from the Indian Ocean. Having reexamined Balss's (1912) ovigerous female specimen of *N. indicus* from the Nicobar Islands (ZMB 16475) we have concluded that *N. alcocki* also bears considerable similarity to *N. indicus.* No specimens referable to Alcock's (1905b) taxon were found in the collections of the Institute of Oceanology, thus it is probable that Wang & Huang's (1979), Wang's (1983, 1992, 1994), and Huang's (1989) reports of *N. indicus* should be referred to *N. alcocki.* The reports by Miyake (1961) and Miyake et al. (1962) of *N. indicus* were corrected by Miyake (1978) to *N. vallatus.* However, McLaughlin & Sandberg (1995) showed that Miyake's (1978, 1982) and Miyake & Imafuku's (1980) specimens actually were conspecific with the species McLaughlin (1992) attributed to *N. tricarinatus* (as *Ceratopagurus*). Therefore, while *N. vallatus* does occur in the Japanese Bonin Islands, the species occurring in the South China Sea and southern Japan is *N. tricarinatus.*

Nematopagurus australis
(Henderson, 1888)

Catapagurus australis Henderson, 1888:76, pl. 8, fig. 1.

Nematopagurus gardineri—Haig & Ball, 1988:185 (not *Nematopagurus gardineri* Alcock, 1905a).

Nematopagurus muricatus—Wang, 1983: 54 (list).—Rahayu, 1996:350 [not *Nematopagurus muricatus* (Henderson, 1896)].

Nematopagurus australis—McLaughlin, 1997:505.

Material examined.—R/VK, NCOS Stn. 6106, 20°30′N, 112°00′E, 71 m, 3 Jul 1959, 1 ♀ sl = 1.4 mm, IOCAS K50B; R/VS, NCOS Stn. 6030, 21°30′N, 115°30′E, 115 m, 14 Jul 1959, 1 ♂ sl = 1.8 mm, 1 ovig. ♀ sl = 2.9 mm, IOCAS SIII19B; R/VS, NCOS Stn. 6038, 21°00′N, 115°00′E, 100 m, 4 Apr 1959, 1 ♂ sl = 2.1 mm, IOCAS SIII18B; R/VS, NCOS Stn. 6038, 21°00′N, 115°00′E, 103 m, 14 Jul 1959, 1 ♂ sl = 2.1 mm, 1 ♀ sl = 2.2 mm, IOCAS S67B-9, 10; R/VS, NCOS Stn. 6048, 21°00′N, 114°30′E, 85 m, 10 Jul 1959, 1 ♂ sl = 2.0 mm, 1 ♀ sl = 1.8 mm, IOCAS SIII8B; R/VS Stn, 6093, 19°30′N, 112°30′E, 219 m, 6 Apr 1960, 1 ♂ sl = 2.7 mm, 1 ovig. ♀ sl = 3.3 mm, IOCAS K151B-15; R/V21, NCOS Stn. 6093, 19°30′N, 112°30′E, 219 m, 17 Feb 1959, 2 ♂ sl = 3.0, 3.1 mm, IOCAS 6–21; R/V101, NCOS Stn. 6141, 19°15′N, 111°00′E, 80 m, 10 Feb 1960, 1 ♂ sl = 1.8 mm, IOCAS N120R-32; R/V101, NCOS Stn. 6175, 17°45′N, 110°00′E, 105 m, 10 Mar 1960, 1 ♀ sl = 2.4 mm, IOCAS N114B-54; R/V101, NCOS Stn. 6181, 18°10′N, 109°45′E, 65 m, 12 May 1960, 1 ♀ sl = 2.4 mm, IOCAS N200B-63; R/V101, NCOS Stn. 6186, 18°00′N, 109°30′E, 74 m, 11 Mar 1959, 1 ♀ sl = 2.7 mm, IOCAS N148B-43; R/V101, NCOS Stn. 6210, 18°15′N, 108°24′E, 38 m, 7 Mar 1959, 2 ♀ sl = 2.0, 2.6 mm, IOCAS N158B-6; R/V131, NCOS Stn. 6141, 19°15′N, 111°00′E, 79 m, 13 Jul 1959, 1 ♂ sl = 3.8 mm, IOCAS N120B-

32; R/V131, NCOS Stn. 6215, 20°30′N, 108°30′E, 50 m, 19 Apr, 1959, 1 ♂ sl = 3.3 mm, IOCAS N428-22; R/V171, NCOS Stn. 6141, 19°15′N, 111°00′E, 78 m, 22 Jan 1959, 1 ovig. ♀ sl = 2.4 mm, IOCAS 15–36; R/V171, NCOS Stn. 6144, 18°30′N, 111°00′E, 140 m, 27 Jan 1959, 1 ♂ sl = 3.0 mm, 1 ♀ sl = 3.2 mm, USNM 1003651; R/V171, NCOS Stn. 6166, 16°30′N, 110°30′E, 72 m, 20 Apr 1959, 1 ♂ sl = 3.2 mm, IOCAS L568-62; R/V220, NCOS Stn. 6030, 21°30′N, 115°30′E, 115 m, 13 Apr 1959, 1 ♂ sl = 2.0 mm, 1 ♀ sl = 2.0 mm, IOCAS 219B; R/V220, NCOS Stn. 6052, 21°30′N, 114°00′E, 48 m, 17 Mar 1952, 1 specimen, poor condition, IOCAS 15–49; R/V220, NCOS Stn. 6054, 21°00′N, 114°00′E, 80 m, 10 Dec 1959, 1 ♀ sl = 2.1 mm, IOCAS, S199B-26; R/V220, NCOS Stn. 6054, 21°00′N, 114°00′E, 79 m, 11 Jan 1960, 1 ♂ sl = 2.6 mm, IOCAS S242B; R/V228, NCOS Stn. 6227, 17°30′N, 108°30′E, 97 m, 7 Nov 1959, 1 ♀ sl = 2.4 mm, IOCAS Q75B-59; R/V307, NCOS Stn. 6168, 18°30′N, 110°15′E, 46 m, 4 Apr 1959, 1 ovig. ♀ sl = 2.9 mm, IOCAS Q25-10; R/V307, NCOS Stn. 6173, 18°15′N, 110°00′E. 85 m, 29 Jan 1959, 1 ♂ sl = 3.5 mm, IOCAS 13–32; R/V307, NCOS Stn. 6242, 18°30′N, 108°00′E, 72 m, 17 Sep 1959, 1 ovig. ♀ sl = 2.3 mm, IOCAS Q18B-8; R/V307, NCOS Stn. 6243, 18°00′N, 108°00′E, 86 m, 16 Apr 1959, 1 ♀ sl = 2.7 mm, IOCAS Q56B-7; R/V394, NCOS Stn. 6154, 19°15′N, 110°45′E, 38 m, 10 Jul 1959, 1 ♂ sl = 3.0 mm, IOCAS R26B; R/V394, NCOS Stn. 6219, 19°30′N, 108°30′E, 52 m, 25 Jan 1959, 1 ovig. ♀ sl = 3.9 mm, IOCAS 30-8; R/V394, NCOS Stn. 6226, 17°45′N, 108°30′E, 79 m, 28 Jan 1959, 1 ♂ sl = 4.7 mm, IOCAS 16-8.

Remarks.—Henderson's (1888) *N. australis* initially was described as *Catapagurus australis,* but was transferred to *Nematopagurus* by McLaughlin (1997) after an examination of the two syntypes and, at that time, the only known specimens. Although the type localities of the Arafura Sea and Fiji suggest a potentially broad distribution for this species, the only other tentative report is that of McLaughlin (2002) for a specimen collected in the Andaman Sea. *Nematopagurus australis* has proven to be the most abundant species of the genus in the Institute of Oceanology collections. As indicated above, it most frequently was misidentified as *N. muricatus* by resident scientists. Henderson's (1896) *N. muricatus* was also initially described in *Catapagurus,* but was transferred to *Nematopagurus* by Alcock (1905a). Although *N. muricatus* was accurately diagnosed by Alcock (1905a, 1905b), it has repeatedly been misinterpreted (e.g., Laurie 1926, Thompson 1943, Lewinsohn 1969, Miyake 1978, Wang 1983; Rahayu 1996, 2000). *Nematopagurus muricatus* is distinguished from all other species in the genus by the very stout, blunt, tubular spines on the dorsal surfaces of the chelae (cf. Türkay 1986, fig. 9). No specimens actually identifiable as *N. muricatus* have been found in the South China Sea.

Nematopagurus australis is most closely allied to *N. meiringae,* a species described from the eastern coast of South Africa (McLaughlin 1998), but during the present study found in both the South and East China Seas. No single diagnostic character will readily separate the two taxa and intraspecific variations sometimes make differentiation difficult. *Nematopagurus australis* most commonly has only a very short mat of setae on the dorsal surfaces of the chelas, although longer setae frequently are present marginally; the dactyl of the right chela lacks much surface setae. In contrast, a usually dense, moderate to long covering of simple and plumose setae is present on the dorsal surfaces of the chelas of *N. meiringae,* together with long plumose setae marginally; the dactyl of the right chela is similarly provided with a moderate covering of setae. The corneal diameter of *N. australis* varies from 0.33 to 0.48 of the peduncular length in the present material, whereas this diameter in *N. meiringae* varies from 0.46

to 0.72 of the peduncular length. Thus, generally speaking, the ocular peduncles are slightly longer and the corneas slightly less dilated in *N. australis*. The ambulatory dactyls, particularly the third left, is typically longer, more slender, and more strongly arched in *N. australis* than in *N. meiringae*. However, unless both species are available for comparison, the best means of separating these two taxa is by the density of the setation of the chelas.

Nematopagurus diadema Lewinsohn, 1969

Nematopagurus diadema Lewinsohn, 1969: 74, fig. 13.—McLaughlin, 1998:325, fig. 3.

Material examined.—R/V171, NCOS Stn. 6108, 19°30′N, 112°00′E, 120 m, 26 Apr 1959, 1 ovig. ♀ sl = 2.0 mm, IOCAS L58B; R/V171, NCOS Stn. 6120, 20°00′N, 111°30′E, 77 m, 26 Jan 1959, 1 ♂ sl = 2.1 mm, IOCAS 47B.

Remarks.—*Nematopagurus diadema* was described from seven males and two ovigerous females collected at a depth between 62 and 80 m in the Red Sea (Lewinsohn 1969). One ovigerous female was subsequently collected in the Mozambique Channel off the coast of eastern South Africa at a depth between 120 and 150 m (McLaughlin 1998). The two specimens collected in the South China Sea are well within the depth range recorded for the species. *Nematopagurus diadema* is such a unique species in having the chelipeds armed with ball-like tubercles and platelets (Lewinsohn 1969: fig. 13; McLaughlin 1998: fig. 3C) that there can be no doubt as to its identity, despite the very major extension of its known range.

Nematopagurus lepidochirus
(Doflein, 1902)

Eupagurus lepidochirus Doflein, 1902:623.
Pagurus lepidochirus—Miyake, 1978:81 (key).
Nematopagurus squamichelis—Miyake, 1978:129 (key).—Wang & Huang, 1979: 63.—Miyake & Imafuku, 1980:63.—Wang, 1983:55 (list); 1992:61 (list); 1994:571 (list).—Baba, 1986:201, 303, unnumbered fig.—Huang, 1989:254, fig. 215.—Komai, 1999:28.—Rahayu, 2000: 394 (not *Nematopagurus squamichelis* Alcock, 1905b).
Nematopagurus lepidochirus—Komai & McLaughlin, 2001:83, figs. 1–4.

Material examined.—R/V2, NCOS Stn. 6094, 19°00′N, 112°30′E, 290 m, 6 Apr 1959, 1 ♂ sl = 3.9 mm, 1 ♀ sl = 6.0 mm, IOCAS K150B; R/V21, NCOS Stn. 6094, 19°00′N, 112°30′E, 270 m, 7 Feb 1959, 1 ♀ sl = 4.4 mm, IOCAS 7–15; R/V21, NCOS Stn. 6094, 19°00′N, 112°30′E, 270 m, 19 Apr 1959, 1 ♂ sl = 5.5 mm, IOCAS K32B-75; R/V171, NCOS Stn. 6109, 19°112′N, 112°00′E, 194 m, 27 Jan 1959, 1 ♀ sl = 3.7 mm, IOCAS L59B; R/V1082, NCOS Stn. 6080, 19°30′N, 113°00′E, 210 m, 10 Feb 1960, 2 ♂ sl = 4.3, 5.1 mm, 2 ♀ sl = 3.0, 4.7 mm, IOCAS K135B.

Remarks.—Like others of Alcock's (1905a, 1905b) species of *Nematopagurus*, *N. squamichelis* has been misinterpreted by several authors; however, not all authors misinterpreted this taxon in the same way. The species identified in Japanese and Chinese waters as *N. squamichelis* (e.g., Miyake 1978, Wang & Huang 1979, Miyake & Imafuku 1980, Miyake 1982, Wang 1983, Baba 1986, Huang 1989, Wang 1994, Komai 1999, Rahayu 2000) has been shown by Komai & McLaughlin (2001) to actually be *N. lepidochirus*. Although described initially in the genus *Pagurus* (as *Eupagurus*), an examination of the type material proved conclusively that Doflein's (1902) species belonged in *Nematopagurus*. It does not appear to be an abundant species in the South China Sea.

Nematopagurus meiringae
McLaughlin, 1998

Nematopagurus gardineri—Kensley, 1969: 163, fig. 6e–h (not *Nematopagurus gardineri* Alcock, 1905a).

?*Nematopagurus gardineri*—Wang, 1983: 54 (list); 1992:61 (list); 1994:571 (list) (not *Nematopagurus gardineri* Alcock, 1905a).

Nematopagurus meiringae McLaughlin, 1998:332, fig. 6.

Material examined.—R/V2, NCOS Stn. 6108, 19°30′N, 112°00′E, 124 m, 4 Apr 1960, 1 ♀ sl = 2.6 mm, IOCAS K148B; R/V171, NCOS Stn. 6108, 19°30′N, 112°00′E, 120 m, 20 Apr 1959, 1 ovig. ♀ sl = 2.6 mm, IOCAS L58B; R/V171, NCOS Stn. 6120, 20°00′N, 111°30′E, 77 m 26 Jan 1959, 1 ♂ sl = 2.9 mm, IOCAS K148B; R/VV, Stn. 1V-5, 28°30′N, 125°30′E, 125 m, 4 Jul 1976, 1 ♂ sl = 2.7 mm, IOCAS V495B-60; R/VV, Stn. V-3, 27°30′N, 124°00′E, 105 m, 4 Jul 1976, 1 ♂ sl = 2.1 mm, 2 ovig. ♀ sl = 2.1, 2.6 mm, IOCAS V519B-135; R/VV, Stn. V-6, 27°30′N, 125°30′E, 115 m, 4 Jul 1976, 1 ♂ sl = 3.0 mm, IOCAS V499B-15; R/VV, Stn. V-6, 27°30′N, 125°30′E, 112 m, 5 Jul 1976, 2 ♂ sl = 2.0, 2.6 mm, 2 ovig. ♀ sl = 2.3, 3.5 mm, IOCAS V496B-16; R/VV, Stn. V-7, 27°30′N, 125°00′E, 131 m, 5 Jul 1976, 1 ♂ sl = 2.1 mm, 3 ♀ sl = 2.0–2.3 mm, 1 ovig. ♀ sl = 2.3 mm, IOCAS V498B-29; R/VV, Stn. VI-3, 26°30′N, 123°00′E, 98 m, 4 Jul 1976, 2 ovig. ♀ sl = 2.4, 3.0 mm, IOCAS V494B-16.

Remarks.—Like *N. muricatus,* Alcock's (1905a) *N. gardineri* has been frequently misinterpreted (e.g., Kensley 1969, Miyake 1978, Haig & Ball 1988). Having examined the holotype of Alcock's (1905a) taxon, we can confidently say that it is not included in the collections of the Institute of Oceanology. *Nematopagurus gardineri* is most readily identified by its moderately long ocular peduncles that lack any noticeable corneal dilation. McLaughlin (1998) compared *N. gardineri* with *N. meiringae,* and was able to readily separate the two taxa, not only by the lack of corneal dilation in *N. gardineri,* but also by the row of corneous spines on the dorsal surface of each ambulatory dactyl. The dorsal surfaces of the dactyls of *N. meiringae* are provided with long stiff setae. It is most probable that specimens reported by Wang (1983, 1992, 1994) and Huang (1989) as *N. gardineri* are actually *N. meiringae.*

As previously discussed, *N. australis* and *N. meiringae* are morphologically very similar species. While their distributions overlap in the northern part of the South China Sea, only *N. meiringae* has been found in the East China Sea. In contrast, only *N. australis* is present in the southern part of the South China Sea. *Nematopagurus meiringae* also generally appears to inhabit areas of greater depth.

Nematopagurus tricarinatus (Stimpson, 1858)

Eupagurus tricarinatus Stimpson, 1858: 251.—Ortmann, 1892:309.

Ceratopagurus tricarinatus—McLaughlin, 1992:795, figs. 1, 2.

Nematopagurus indicus—Miyake, 1961: 12.—Miyake et al., 1962:126 (list) (not *Nematopagurus indicus* Alcock, 1905b).

Nematopagurus vallatus—Miyake, 1978: 131, fig. 52; 1982:121, pl. 41, fig. 4.—Miyake & Imafuku, 1980:63, pl. 2, fig. 8.—Wang, 1992:61 (list); 1994:571 (list) [not *Nematopagurus vallatus* (Melin, 1939)].

Nematopagurus tricarinatus—McLaughlin & Sandberg, 1995:579.

Material examined.—R/VS, NCOS Stn. 6012, 22°30′N, 117°00′E, 48 m, 20 Jul 1959, 2 ♂ sl = 1.7, 2.1 mm, 1 ♀ sl = 2.0 mm, 2 ovig. ♀ sl = 2.0, 2.1 mm, IOCAS SIII33B; R/VS, NCOS Stn. 6021, 22°15′N, 116°00′E, 51 m, 9 Jul 1959, 1 specimen, poor condition, IOCAS SIII23B; R/VS, NCOS Stn. 6059, 21°30′N, 113°45′E, 45 m, 9 Dec 1959, 1 ♀ sl = 1.7 mm, IOCAS S138B; R/V2 NCOS Stn. 6063, 21°30′N, 113°30′E, 41 m, 24 Apr 1959, 8 ♂ sl = 1.7–3.8 mm, 3 ♀ sl = 1.8–2.4, 5 ovig. ♀ sl = 2.4–2.9 mm, IOCAS K42B; R/V121, NCOS Stn. 6140, 19°30′N, 111°00′E, 39 m, 29 Oct 1959, 1 ovig. ♀ sl = 3.8 mm, IO-

CAS N95B-24; R/V171, NCOS Stn. 6063, 21°30′N, 113°30′E, 39–18 m, 20 Feb 1959, 5 ♂ sl = 2.0–4.2 mm, 2 ♀, 1.7, 2.0 mm, 2 ovig. ♀ sl = 2.9, 3.2 mm IOCAS 39–18, 39–19; R/V171, NCOS Stn. 6166, 16°30′N, 110°30′E, 72 m, 20 Apr 1959, 1 ♂ sl = 3.0 mm, IOCAS L568-62; R/V220, NCOS Stn. 6006, 23°00′N, 117°30′E, 42 m, 4 Jan 1959, 1 ovig. ♀ sl = 3.3 mm, IOCAS S114B-32; R/V 220, NCOS Stn. 6012, 22°30′N, 117°00′E, 43 m, 3 Mar 1959, 1 ovig. ♀ sl = 2.4 mm, IOCAS 538B-3; R/V 220, NCOS Stn. 6052, 21°30′N, 114°00′E, 48 m, 17 Mar 1959, 9 ♂ sl = 2.6–4.7 mm, 4 ♀ sl – 1.7–2.4 mm, IOCAS 15–47; R/V 220, NCOS Stn. 6059, 21°30′N, 113°45′E, 38 m, 17 Mar 1959, 1 ♂ sl = 3.2 mm, 1 ovig. ♀ sl = 3.3 mm, USNM 1003652; R/V 228, NCOS Stn. 6015, 22°30′N, 118°30′E, 43 m, 10 Jan 1960, 1 ♂ sl = 3.5 mm, 4 additional specimens, poor condition IOCAS Q107B, Q120B.

Remarks.—There has been considerable uncertainty as to the true identity of Stimpson's (1858) *Pagurus tricarinatus* (as *Eupagurus*) since the type material is no longer extant. McLaughlin (1992) recorded what she believed to be Stimpson's taxon from the South China Sea, and assigned it to Yokoya's (1933) *Ceratopagurus.* McLaughlin & Sandberg (1995) reexamined Melin's (1939) syntypes of *N. vallatus* and noted that Melin's specimens had tubercles on the dorsal surfaces of the palms of the chelae between the elevated keels. McLaughlin's (1992) South China Sea specimens, in contrast, had smooth surfaces. As indicated in the remarks under *N. alcocki,* Japanese specimens identified by Miyake (1978) and Miyake & Imafuku (1980) as *N. vallatus* were shown by McLaughlin & Sandberg (1995) to be conspecific with McLaughlin's (1992) *Ceratopagurus tricarinatus.* Although McLaughlin & Sandberg (1995) transferred *C. tricarinatus* to *Nematopagurus* as a distinct taxon, they stated their uncertainty about the presence of tubercles as a species-specific character. All of the specimens in the Institute of Oceanology collections have smooth surfaces between the keels. We believe that this confirms their identities as *N. tricarinatus,* and the diagnostic merit of this character.

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